Modelos Jolly-Seber

Supuestos adicionales JS

5. La probabilidad de individuo ser capturado es igual entre los individuos marcados y no marcados.

6. La probabilidad de sobrevivir es igual entre los individuos marcados y los no marcados.

7. El área de estudio es constante.

Abundancia, supervivencia, reclutamiento

1.- Supuesto adicional: La probabilidad de capturar un individuo marcado previamente y uno no marcado es la misma.

2. Supervivencia: k-1, recaptura ?, posibles parámetros adicionales λ, f, b, reclutamiento de individuos.

Estimabilidad en los modelos globales phi(t) p(t) λ(t) o f(t), restricciones a parámetros.

JS-POPAN (Arnason-Schwarz)

Superpoblación, “todos los individuos que han pasado por la población”

Concepto útil en todas las especies que cuentan con poblaciones transitorias (stopover), mariposas monarca, salmones

Jolly Seber Pradel

λ, Tasa de crecimiento finito.

lambda(i)= N(i+1)/ N(i) = phi(i)+f(i)

f: fecundidad. Número de invididuos que son reclutados en el tiempo i+1 por individuos presentes en el tiempo i.

$$N(i+1) = N(i)\, f(i) + N(i)\, \mathrm{phi}(i)$$

Jolly-Seber formulaciones

Figure 13.1: *Original process model for JS experiments. p_i represents the probability of capture at occasion i; ϕ_i represents the probability of an animal surviving between occasions i and $i+1$; and M_i and U_i represents the number of marked and unmarked animals alive at occasion i. Losses-on-capture are not modeled here, but are easily included.*

$$\begin{array}{cccccccccc} & \phi_1 & & \phi_2 & & \phi_3 & & \phi_4 & & \\ t_1 & \rightarrow & t_2 & \rightarrow & t_3 & \rightarrow & t_4 & \rightarrow & t_5 & \ldots \\ \uparrow & & \uparrow & & \uparrow & & \uparrow & & \uparrow & \\ p_1 & & p_2 & & p_3 & & p_4 & & p_5 & \\ M_1 & & M_2 & & M_3 & & M_4 & & M_5 & \\ U_1 & & U_2 & & U_3 & & U_4 & & U_5 & \end{array}$$

Ejemplo: *Microtus*

Jolly-Seber formulaciones: Popan

Figure 13.2: *Process model for POPAN parameterization of JS experiments. p_i represents the probability of capture at occasion i; ϕ_i represents the probability of an animal surviving between occasions i and $i+1$; and b_i represents the probability that an animal from the super-population (N) would enter the population between occasions i and $i+1$ and survive to the next sampling occasion $i+1$. Losses-on-capture are assumed not to happened, but are easily included.*

$$
\begin{array}{ccccccccccc}
b_0 & & b_1 & & b_2 & & b_3 & & b_4 & & N \\
 & & \phi_1 & & \phi_2 & & \phi_3 & & \phi_4 & & \\
 & t_1 & \rightarrow & t_2 & \rightarrow & t_3 & \rightarrow & t_4 & \rightarrow & t_5 & \dots \\
 & \uparrow & & \uparrow & & \uparrow & & \uparrow & & \uparrow & \\
 & p_1 & & p_2 & & p_3 & & p_4 & & p_5 &
\end{array}
$$

Ejemplo: *Microtus,*
Pent: función liga Mlogit

Jolly-Seber formulaciones: Popan

Table 13.2: *Confounded parameters in the POPAN parameterization in the fully time-dependent model. In order to resolve this confounding, the models must make assumptions about the initial (p_1) and final (p_K) catchabilities. For example, a model may assume that catchabilities are equal across all sampling occasions.*

Function	*Interpretation*
$\phi_{K-1}p_K$	Final survival and catchability.
b_0p_1	Initial entrance and catchability.
$b_1 + b_0(1 - p_1)\phi_1$	Entry between first and second occasions cannot be cleanly estimated because initial entrance probability cannot be estimated. **MARK** (and other programs) will report an estimate for this complicated function of parameters but it may not be biologically meaningful.
b_{K-1}/ϕ_{K-1}	Entry prior to last sampling occasion cannot be cleanly estimated because final survival rate cannot be estimated. **MARK** (and other programs) will report an estimate for this complicated function of parameters but it may not be biologically meaningful.

Ejemplo: *Microtus*

Jolly-Seber: Reclutamiento Pradel

Figure 13.3: *Process model for Link-Barker and Pradel-recruitment parameterization of JS experiments. p_i represents the probability of capture at occasion i; ϕ_i represents the probability of an animal surviving between occasions i and $i+1$; and f_i represents the net recruitment rate, i.e., the per capita number of new animals that enter between occasions i and $i+1$ and survive to the next sampling occasion $i+1$ per animal alive at occasion i. Losses-on-capture are assumed not to happened, but are easily included.*

$$\begin{array}{ccccccccccc}
 & f_1 & & f_2 & & f_3 & & f_4 & & & \\
 & \phi_1 & & \phi_2 & & \phi_3 & & \phi_4 & & & \\
t_1 & \rightarrow & t_2 & \rightarrow & t_3 & \rightarrow & t_4 & \rightarrow & t_5 & & \dots \\
\uparrow & & \uparrow & & \uparrow & & \uparrow & & \uparrow & & \\
p_1 & & p_2 & & p_3 & & p_4 & & p_5 & &
\end{array}$$

Ejemplo: *Microtus*

Jolly-Seber: λ

Figure 13.4: *Process model for Burnham and Pradel-λ parameterization of JS experiments. p_i represents the probability of capture at occasion i; ϕ_i represents the probability of an animal surviving between occasions i and $i+1$; and λ_i represents the rate of population change. The population size at time 1, N_1 is used by the Burnham formulation, but not by the Pradel-λ formulation. Losses-on-capture are assumed not to happened, but are easily included.*

$$
\begin{array}{ccccccccccc}
 & \phi_1 & & \phi_2 & & \phi_3 & & \phi_4 & & \\
 & \lambda_1 & & \lambda_2 & & \lambda_3 & & \lambda_4 & & \\
t_1 & \rightarrow & t_2 & \rightarrow & t_3 & \rightarrow & t_4 & \rightarrow & t_5 & \ldots \\
\uparrow & & \uparrow & & \uparrow & & \uparrow & & \uparrow & \\
p_1 & & p_2 & & p_3 & & p_4 & & p_5 & \\
N_1 & & & & & & & & &
\end{array}
$$

Jolly-Seber: λ

Table 13.4: *Confounded parameters in the Pradel-λ parameterization in the fully time-dependent model. In order to resolve this confounding, the models must make assumptions about the initial (p_1) and final (p_K) catchabilities. For example, a model may assume that catchabilities are equal across all sampling occasions.*

Function	*Interpretation*
$\phi_{K-1}p_K$	Final survival and catchability
$\lambda_1 - \phi_1 p_1$	Initial growth and survival
$\lambda_{K-1}p_K$	Final recruitment and catchability cannot be cleanly estimated. **MARK** (and other programs) will report an estimate for this complicated function of parameters but it may not be biologically meaningful.

Jolly-Seber: λ

Table 13.4: *Confounded parameters in the Pradel-λ parameterization in the fully time-dependent model. In order to resolve this confounding, the models must make assumptions about the initial (p_1) and final (p_K) catchabilities. For example, a model may assume that catchabilities are equal across all sampling occasions.*

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$\phi_{K-1}p_K$	Final survival and catchability
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Jolly-Seber: Atributos diferentes modelos

Table 13.5: *Summary of criteria to choose among the different JS formulations*

formulation	losses on capture	estimates available for *abundance*	*net births*	*recruitment*	λ
POPAN	yes	yes	yes	no	no
Link-Barker	yes	no	no	yes	no
Pradel-recruitment	no	no	no	yes	no
Burnham JS	yes	yes	yes	no	yes
Pradel-λ	yes	no	no	no	yes

- The implementation of Burnham's JS model in **MARK** often does not converge, and is not recommended
- The standalone package of *POPAN* will estimate recruitment, and population growth as derived parameters

Ejemplo

Salmon coho, archivo: chase.inp,

10 semanas, 8 periodos.

Intervalos de tiempo irregulares: 1.5 y 1.5, 1ro y último